Title: Mould holder

The present invention relates to a mould holder comprising an accomodation for receiving a mould part and a fixing for fixing to an injection moulding machine.

Such a mould holder is generally known in the art and is used to impart rigidity to mould parts that are relatively weak. Such separation of the mould part, in which the shape of the product to be injected has been made, and the mould holder is employed in particular if relatively small series, of up to approximately 1,000 items, have to be produced. In such a case the high costs for the production of a complete mould are not justified by the size of the series. Special series and prototypes are considered in particular here. In such cases the mould part is, for example, made of aluminium, which can be machined easily, or of another metal that can be machined easily.

If the mould becomes larger, the forces acting thereon for a given injection pressure will be appreciable. Large moulds are used, for example, in the automotive industry when producing large items from plastic, such as doors, wheel arches, bonnets and bumpers.

In order to obtain adequate rigidity for the actual mould part it is proposed in the state of the art to produce the mould holder from one part that is particularly rigid. This means that the size thereof as well as the weight is appreciable. This does not benefit the ease of handling and, moreover, it becomes increasing more difficult to place the various parts in an injection moulding machine. Moreover, with large dimensions it is difficult to provide an accurate fit between mould part and mould holder. However, stringent requirements are imposed on this fit. After all, if there is even only a slight gap between the two mould parts when the mould closes, a flash will be produced. The removal thereof is associated with appreciable post-machining costs and is not beneficial for the appearance of the product.

Despite the series being small, the costs of items rise appreciably if these require a post-machining step. The tolerance between the two mould parts stays the same as these become larger. After all, the properties of the plastic do not change with the size of the mould.

The aim of the present invention is to provide a mould holder for a mould part, which

mould holder has a structure that is not too bulky, can be handled relatively easily and can accommodate the mould part accurately with small tolerance.

This aim is realised with a mould holder described above in that said mould holder comprises two end face parts located opposite one another and spacers arranged between them, wherein said accomodation is delimited between said end parts and said spacers and wherein there are first prestressing means to pull said end face parts towards one another with prestressing.

According to the present invention the strength of the mould holder is obtained by prestressing. This prestressing acts in the sense of compression of the mould holder without deformation. As a result the strength, and thus the weight, of the mould holder can be relatively low because when the injection pressure, which can be many hundred tonnes, is applied, the amount of stress on the pre-stressed elements first has to be overcome before deformation of the mould holder takes place. As a result of the use of spacers it can be guaranteed that the mould part does not give way under the prestressing force. The spacers absorb the force applied between the end parts, whilst the spacers can also be prestressed with respect to one another. In order to be able to absorb the associated force, these are preferably made triangular, the thickest part being located between the ends thereof.

The prestressing force can be applied in any way known in the state of the art. According to an advantageous embodiment, tensioning rods are used. Very high forces can be applied by this means. A value of approximately 100 tonne per tensioning rod is mentioned by way of example. If, for example, there are 16 tensioning rods, a force of up to 1600 tonne can be absorbed during injection moulding before the material of the mould holder is subjected to tensile stress. It has been found that despite such a high prestressing force it is possible to work with very small tolerances between the mould part and the mould holder. Accuracies of 0.1 mm or less can be achieved, as a result of which the phenomenon of flash formation described above is avoided.

Another method for applying prestressing is hydraulic. With a hydraulic fluid pressure can be built up between the mould holder and the mould part. Such a fluid can, for example, be applied with a cylinder/piston combination and preference is given to providing the mould

holder with a cavity in which a bag to be filled with hydraulic fluid is present. By this means a force can be applied that acts between the mould holder and the mould part. This is mainly used to absorb forces at right angles to the longitudinal direction of the mould holder. In any event the lowest spacers are provided with a recess 20 close to the "raised" mid section for accommodating a bag 21 to be filled with fluid. Such a bag 21 is placed in each of the recesses 20. Of course, it is also possible to fit a single bag in two or more recesses.

This force is, however, applied only after closing the mould parts and/or during injection of the plastic. The force is removed again before the mould parts move apart. It has been found that with the tolerance described above the accuracy of the mould parts with respect to one another during closing is less than a few hundredths of a mm.

The mould holder according to the present invention is preferably used in the automotive industry, but other fields of application are possible.

The invention will be explained below with reference to an illustrative embodiment shown in the drawing. In the drawing:

Fig. 1 shows a perspective and partially exposed view of the construction according to the invention; and

Fig. 2 shows the lower holder without mould part in the completely assembled state.

In Figures 1 and 2 the mould assembly according to the invention is indicated in its entirety by 1. This consists of a upper holder 2, which is indicated only highly diagrammatically, provided with a upper mould part 4. The lower holder 3 and the lower mould part 5 arranged therein are shown in more detail. An accomodation 6, within which the lower mould part is accommodated, is delimited within the lower holder. The lower mould part is provided with a plate 7 for fixing to an injection moulding machine, whilst there are centring ridges 8 which interact with the upper holder 2 so as to centre the mould parts with respect to one another.

The lower holder consists of end parts 10 and 11, located opposite one another, and spacers 12, 13 inserted between them. There are tensioning rods 14 that extend through bores 16, which rods are provided with nuts 15 close to the ends thereof. There are tensioning rods 17 in the bottom and top spacers 12, 13 and these extend through bores 18 in the end part 10, 11. There are nuts 15 here in every case as well. The spacers 12 and 13 are of triangular construction.

It can be seen from Fig. 2 that there are a number of spacers 12, 13 which are arranged around the lower mould part 5 (not shown) when the holder part is built up. Each of these spacers 12, 13 is provided with a piston/cylinder unit 20, 21 and with openings 16 for the tensioning rods 14.

The structure described above functions as follows. A mould part of appreciable size is made from aluminium or other material that is easy to machine. This mould part is placed with a small tolerance of 0.1 mm in a mould holder such as the lower holder 3. This lower holder consists of two end parts 10, 11 positioned some distance apart, between which a number of spacers 12, 13 are stacked on top of one another as desired. In order to guarantee the correct mutual positioning of adjacent spacers 12, 13 and to ensure optimum transmission of forces, provision is made that each spacer 12, 13 is provided with a groove 20. As a result a cavity is always delimited between adjacent spacers 12 or 13, in which cavity a bag 21 can be fitted. During the introduction of the mould part the rods 17 are not present and there is no tension on the rods 14. During the introduction the tensioning rods 17 are not yet present and bag 21 is not yet pressurised with a hydraulic fluid. The tensioning rods 17 are fitted after introducing the mould part.

After introducing the lower mould part into lower holder 3 in this way, the tensioning rods 14 and 17 are tensioned by tightening the nuts 15. As a result of the presence of the spacers 12, 13 and the inherent strength of the mould part, the end parts 10, 11 are prevented from being pulled too far towards one another. As a result of the triangular shape of the spacers 12, 13, these parts are prevented from moving too far apart. A prestressing force of approximately 100 tonne is applied to each of the tensioning rods. The upper holder with mould part is then placed in the injection moulding machine. Of course, prestressing can also take place in the injection moulding machine.

After the same action has optionally been carried out with the upper mould part, the injection moulding machine can be switched on. After the mould parts have closed, that is to say delimiting of the mould cavity, the bag 21 is pressurised and further prestressing is applied. By applying prestressing in this way deformation in the transverse direction (squeezing) is prevented because additional strength is provided by the presence of the upper mould part. After the injection pressure has been released, the prestressing can again be removed and the mould parts can open (after adequate cooling).

It will be understood that a variant embodiment of the invention has been shown only diagrammatically in the drawing. Cooling systems and other special constructions in order to achieve optimum injection have not been shown and the presence thereof is obvious to those skilled in the art.

It has been found that with the construction described above it is possible to produce large parts (such as complete bumpers) with an injection moulding operation, where mould parts that are inexpensive to produce are used, without subsequent post-machining being necessary in order to remove flash and the like.

It will be understood that the invention is not restricted to the variant embodiment described above and that numerous modifications are possible which fall within the scope of the present application.